MEMORANDUM

State of Alaska

Department of Fish and Game
Division of Habitat

TO: Jackie Timothy
Southeast Regional Supervisor

DATE: 9/24/2013

THRU:

SUBJECT: Kanalku Falls Blasting
8/26-28/2013 Trip Report

FROM: Greg Albrecht
Habitat Biologist

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On August 26th through the 28th, 2013, I traveled to Kanalku Lake to assist with a Division of Commercial Fisheries (Commfish) project to improve fish passage over Kanalku Falls (ADF&G Stream No. 112-67-10600; chum, pink, sockeye, and Dolly Varden char present; Fig 1). Commfish contracted with the USFS to conduct the work due to USFS expertise in fish and blasting. Habitat permitted the project and hired Alaska Seismic & Environmental to monitor vibrations in accordance with the Alaska Blasting Standard for the Protection of Fish (Timothy 2013) when fish are in the area during blasting.

USFS and Habitat biologists attempted to conduct the work before fish entered the system in May of 2013, but weather delayed travel and flows were too high to carry out the project. Historic data from the Commfish operated weir at the lake showed that nearly all sockeye pass the falls by the end of August (Appendix A). Stage data showed that about 50% of the time, flows were low enough in the last week of August to carry out the project, but rose rapidly in September (Fig 1). Therefore, to minimize the risk to fish in the system and conduct the work when water levels were low, we determined work would need to occur the last week in August and staff would make every attempt to exclude fish from the blasting zone of impact.

Figure 1 Kanalku Falls under low (August 26th, 2013) and high (September 23rd, 2013) flows. (Photos: Kristen Kolden and Pete Schneider)

Staff on site assisting with fish removal and blasting included Robert Miller (USFS-SRD Blaster-in-Charge), Thor Eide (USFS-JRD Blaster-in-training), Pete Schneider (USFS-JRD Fisheries Biologist), Kristen Kolden and Cathy Aimone-Marten (Alaska Seismic & Environmental, LLC), Ray Vinzant and Kent Crabtree (ADF&G Commfish Biologists), Ben Joseph and Stuart Jack (Hoonah Indian Association weir crew), Randy Bates (ADF&G Habitat Division Director), Matt Kern and myself (ADF&G Habitat Biologists).

Day 1:
Gear mobilization, drill and blast planning, fish presence assessment, weir construction trial, pre-blast photo/video documentation, seismic monitor planning, drilling.

Day 2:
Drilling, final weir construction, fish removal, continued documentation of fish presence and characteristics of the existing jump pool.

Day 3:
Final fish removal, monitoring equipment and test fish set in place, loading /blasting, post-blast assessment of effects to fish, documentation of jump pool depths and bathymetry changes, deconstruction of the weir, demobilization, stream discharge measurement.

Blasting:
Low flow conditions allowed for the exposure of the bedrock for blast planning and drilling. Rob planned a drilling/shooting pattern that would keep overpressures as low as possible, while fracturing most of the rock into small pieces that would wash out during high flows and consulted with Kristen and Cathy on the matter. Drilling took 1.5 days with 3 drills running most of the time and the results of the shot were very close to what was expected. The jump pool was about 50% filled with blast debris immediately after the shot (Figs 2-4). Holes were drilled 5-6' below the water surface; however, the newly excavated hole filled with waste rock and depths varied between 1.4' and 3.2' under the low flow conditions. The jump pool maintained a 15' maximum depth at the upstream end and we determined that conditions were suitable for fish passage so mucking out waste rock would not be necessary. This task would have been overwhelming without heavy equipment. We expect most of the rock to clear out this year during high flows and will go back in the spring to document bathymetry. During drilling, the water was slightly milky downstream and the turbidity associated with the blast cleared within 25 minutes.

Figure 2. Kanalku Falls before (top) and after bottom) the blast (Photos: Randy Bates)

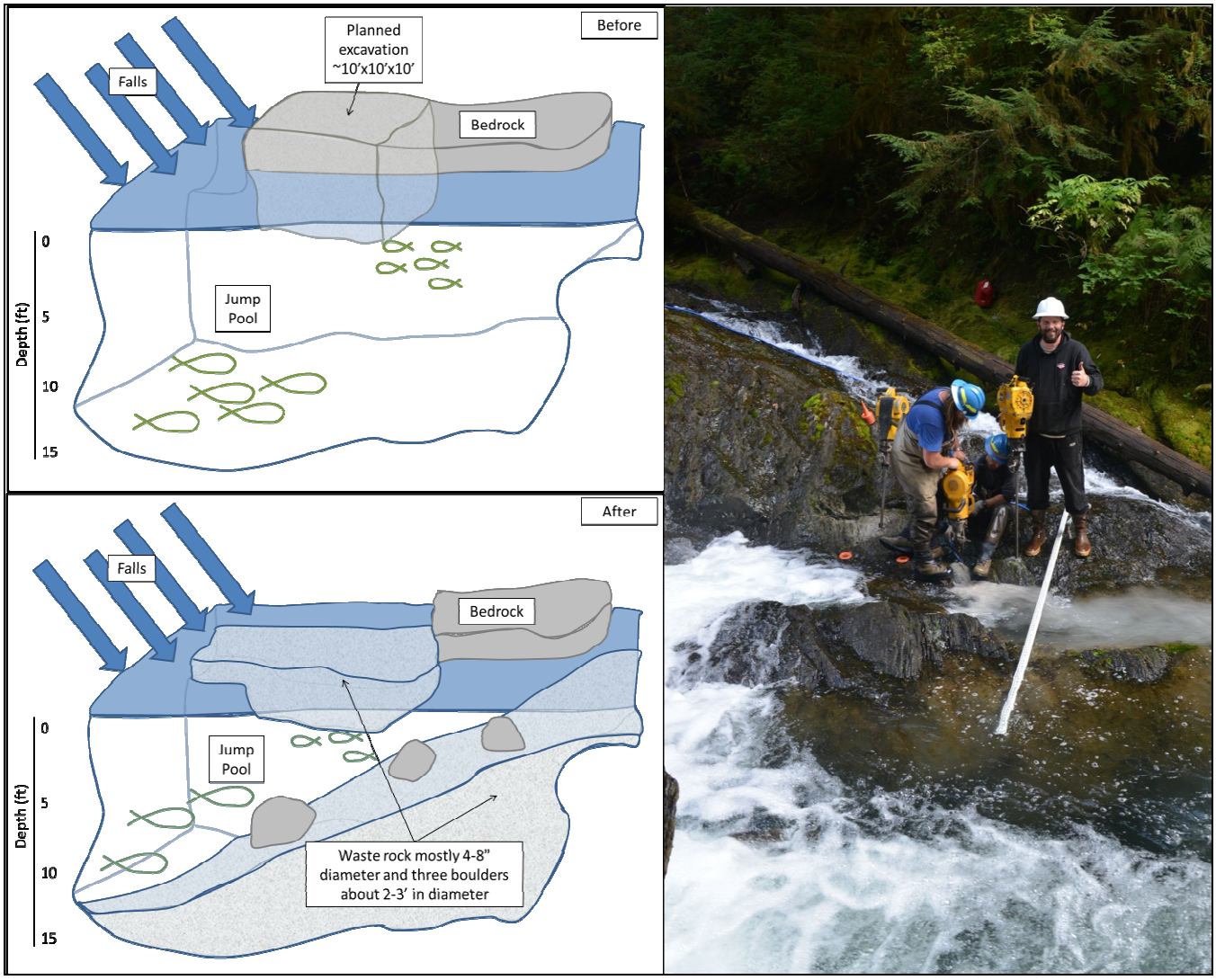

Figure 3. Before and after schematics of the jump pool and blast rock. Rob sports a smile while Thor and Pete operate the Pionjar. (Photo: Kristen Kolden)

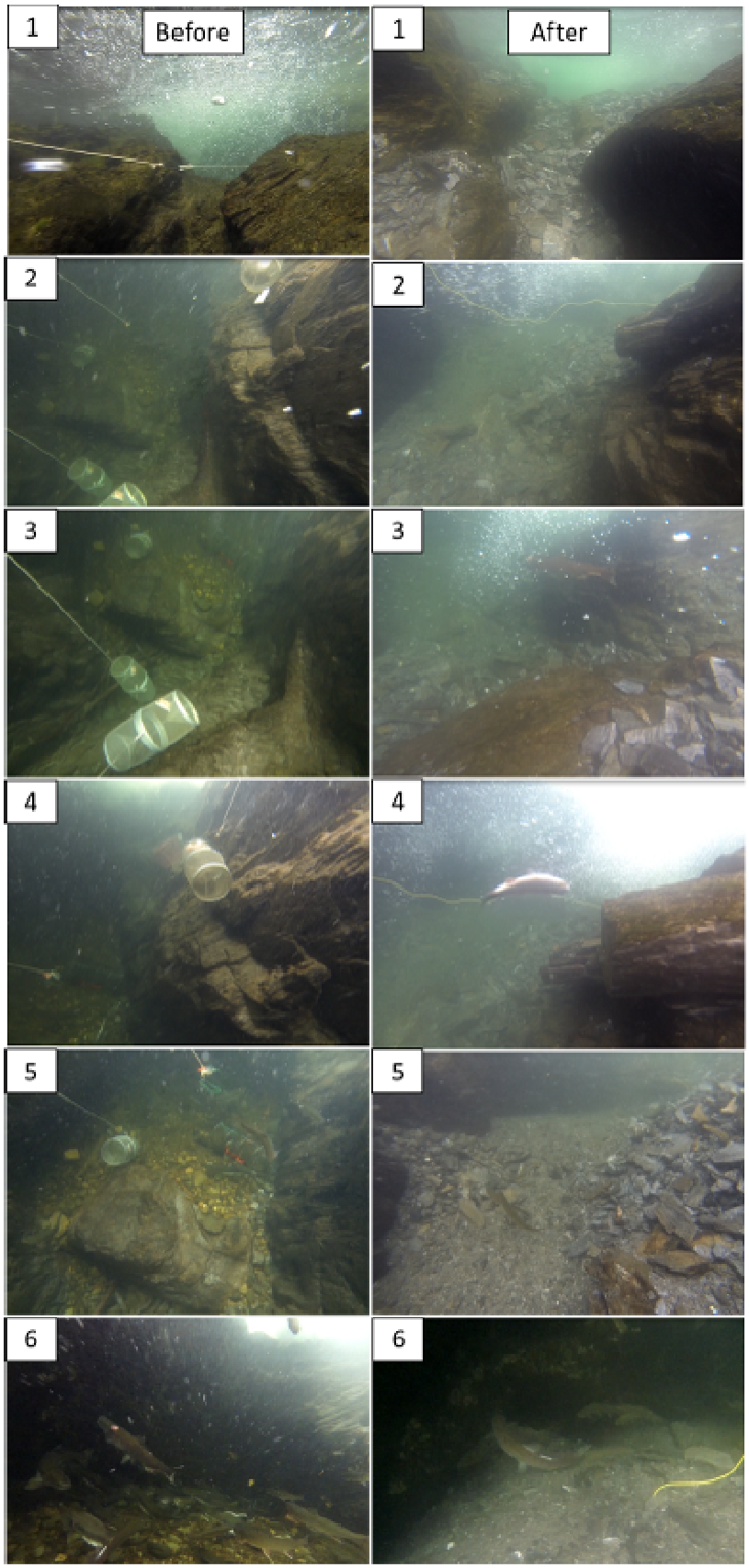

Figure 4. Sequential photos taken while swimming through the jump pool with a GoPro camera before and after the blast. Sockeye with scar (photo 6) recorded in the jump pool ~2 hours prior to the blast was present 30 minutes after the blast (Photo 3).

Vibration Monitoring:
Overpressures from the shot attenuated quickly through the bedrock stream channel and hydrophones placed 15' and 42' feet from the blast center recorded overpressures of 6.63 and 1.33 PSI (Fig 5). A third hydrophone at 57' was malfunctioning and did not record the blast. Geophones placed on bedrock at 24', 43', and 61' recorded peak particle velocities (PPVs) of 0.73, 0.31, and 0.37 in/sec. A geophone placed in the gravel underwater at 49' recorded a PPV of 0.17 in/sec. (See attached Kolden, 2013)

Figure 5. Sealed test cages in place with hydrophone ziptied on (Photo Kristen Kolden)

Fish Response:
Matt and I constructed a weir out of materials brought from Juneau and those available on site to hold fish larger than ~180 mm 185' downstream of the blast center (Fig 6). Fish smaller than ~180 mm were held below the weir in perforated 5-gallon buckets. We used dip nets, a cast net, minnow traps and snagging gear to remove fish upstream of the weir (Fig 7). Minnow traps, cast and dip nets were extremely effective downstream of the jump pool and snagging rods provided by Commfish staff were used to remove most fish from the turbulent and deep jump pool. After snagging with a barbless hook, we quickly released fish into a net and transported downstream. We did not observe any snagging mortalities.

Figure 6. Weir constructed out of rigid and cloth mesh 185' downstream of the blast. (Photo: Randy Bates)

Figure 7. Almost every member of the crew assisted in removing fish from the area. Top left: Greg transfers netted pink salmon into a dipnet for transport. Top right: Greg purses the cast net on fish herded into the area by Matt. Bottom left: Kristen instructs Ben while he makes an excellent throw on his first ever cast net attempt. Bottom right: Ray lands a pink salmon in the cast net for quick transport downstream. (Photos: Kristen and Randy)

On the day of the blast, Matt and I arrived early to find that about 30 salmon had jumped the weir and needed to be removed from the blast area. With drilling operations complete, we were able to safely and effectively snorkel the jump pool (turbidity was high and conditions more dangerous during drilling) and remove all but about 29 of the remaining fish. To accomplish this, Matt would snorkel to the bottom of the jump pool and scare the fish to where I could cast net them while he prevented them from diving down again (Fig 7). We had placed 6 minnow and barrel traps in the jump pool overnight; however, they caught few fish in this area.

We placed juvenile coho (55-75 mm) in 6 sealed Gee minnow traps to monitor their response at known overpressures. Each trap was sealed with zipties and contained a rock for weight and 5 fish (Fig 5). Test

fish were caught and held in minnow traps <16 hours before the blast. We secured two traps each at the 42' and 57' hydrophone stations located in pools with slow current and two behind the weir to serve as experimental controls. The 15' hydrophone station was in high velocity water and was not suitable for holding fish in cages and no other low velocity location was available at this range. We observed the 30 test and control fish in perforated buckets for 3 hours after the blast and saw no signs of injury or mortality (Fig 8). Eighteen injured or dead fish were recovered after the blast in the jump pool and downstream to the weir. We found one adult pink salmon twitching with rapid eye movements about 50' downstream of the blast and released it after its condition improved. We found two adult pinks, 1 adult sockeye and 1 Dolly Varden dead in the bottom of the jump pool along with 10 live fish, the rest of the fish mortalities were either washed up on the weir or found in the stream (Table 1; Fig 9).

Figure 8. Test fish were monitored for 3 hours after the blast then released.

We necropsied the large mortalities and found most fish had internal organ ruptures; kidney and spleen ruptures were easily identified (Fig 10). Overpressure data and our observation of identifiable fish (Fig 4) holding in the bottom of the jump pool before and after the blast suggest mortalities occurred within about 5-10' of the explosion.

Figure 9. Adult pink salmon mortality with a ruptured kidney. (Photo: Randy Bates)

Figure 10. Dolly Varden, cutthroat trout and juvenile coho were among the 18 mortalities found after the blast. (Photo: Randy Bates)

Table 1. Summary of fish removed, mortalities from handling and from the blast with necropsy observations. *DV and CO caught in minnow traps were not recorded on the tally sheet in the field and estimated at release time. **1 sockeye, 6 pinks and 1 DV were entangled in a small section of the weir overnight died.

Fish moved below the weir						
Sockeye	Pink	DV	CT	CO		Total
23	193	~167*	42	~200		~625
Fish handling mortalities						
Sockeye	Pink	DV	CT	CO		
1**	6	10	1	5		23
Live fish observed in the jump pool 2 hours pre-blast						
Sockeye	Pink	DV	CT	CO		
3	6	10	5	5		49
Post-blast Mortalities						
Sockeye	Pink	DV	CT	CO	Caged CO	
1	4	6	4	3	0	18

Necropsy Results

Species	Observations
Pink	3 of 4 fish showed ruptured kidneys, 1 showed external trauma
Sockeye	1 fish found in the bottom of the jump pool with no obvious internal or external injuries
Dolly Varden	4 of the 6 Dolly Varden were examined internally, 3 of which had ruptured kidneys and 1 with a ruptured spleen
Coho	1 out of the 3 coho was examined and had internal bleeding from an unidentified area
Cutthroat	1 out of the 4 cutthroat trout was examined and had internal bleeding from an unidentified area

Discharge Measurement:

A stage marker is present upstream near the weir and the USFS has been collecting data to develop a stage-discharge relationship that can be used to compare passage success and discharge data over multiple years. We measured discharge at 10.9 CFS about 75 yards upstream of the falls under an overhanging alder about 16" in diameter. The old stage marker near the weir read 4.0' and the new one placed on the 4x4 post read 0.1 m.

Conclusion:

2013 was a low water year where 75% percent of the fish passing through the lower weirs navigated the falls and entered the lake. Historic data shows that higher flows inhibit navigation of the falls and often 50% or less are recorded entering the lake in an average flow year (Vinzant and Van Alen Personal Communication). Commfish staff closed the lower weir from August 25th until the 28th to reduce the number of fish at the falls during the blast. After the blast, fish continued to be recorded entering the lake at 1-4 per day until the weir was removed on the 9th of September. This suggest that fish continued to navigate the falls after the blast; however, we cannot be certain of the rate since fish may have been holding in areas upstream of the falls prior to the blast.

Execution of the falls modification went according to plan and appears to have produced the desired jump pool conditions. Based on the results of the caged fish study we know juvenile coho did not experience mortality or irregular behavior within 3 hours of exposure to overpressures up to 1.33 PSI. From our observations in the jump pool before and after the blast, it is reasonable to assume that fish at a distance greater than ~10' survived the blast and that the upper limit of 7.3 PSI, set forth in the 2013 ADF&G blasting standard, proves to be a reasonable number for protection of fish in this instance.

It was unfortunate that fish died during our depletion efforts, but we expect the long term benefits of increased escapement to outweigh the short term effects and know that the data gathered will have long term value. The weir was constructed in a conservative location 185' downstream, which resulted in a large area for fish removal. Had the weir been positioned closer, fewer fish would have had to have been removed and handled.

Recommendations:

- ADF&G Habitat staff will return with USFS JRD staff in the spring to survey the jump pool conditions prior to the arrival of adult sockeye and take discharge measurements.
- ADF&G Commercial Fisheries weir data collection should be continued into the future and used to assess falls modification success and the necessity of phase II falls modifications.
- Use the data from this project to inform future evaluation of the effectiveness of the Alaska Blasting Standard for the Protection of Fish (Timothy 2013).

Please feel free to contact me to see GoPro video documentation.

Attachment:

Kolden, Kristen. 2013. Water overpressure and vibration monitoring report. Alaska Seismic & Environmental, LLC. Juneau, AK.

cc:

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Randy Vigil, USACE, Juneau
NMFS, HCD, Juneau

Appendix A: Weir Data

	Upper Weir							Lower Weir
DAY	2007	2008	2009	2010	2011	2012	2013	2013
25-Jun				0	0		0	2
26-Jun				0	0		0	0
27-Jun				0	0		0	3
28-Jun				0	0		0	5
29-Jun		0		0	1		0	1
30-Jun		0		0	0		1	9
1-Jul		0		0	0		0	3
2-Jul		0		2	0	0	0	6
3-Jul		0	1	0	0	0	2	4
4-Jul		0	2	0	1	0	2	0
5-Jul		0	4	2	0	0	0	89
6-Jul		0	16	1	0	0	3	90
7-Jul		0	48	2	1	0	27	41
8-Jul		0	81	3	2	0	52	32
9-Jul		0	106	16	0	0	30	36
10-Jul		0	141	24	0	0	14	12
11-Jul		0	127	5	0	0	5	18
12-Jul		0	91	29	0	0	18	88
13-Jul			148	9	0	0	21	114
14-Jul		0	148	60	0	0	10	53
15-Jul		0	147	78	0	2	43	20
16-Jul		0	103	110	0	0	32	47
17-Jul		0	104	32	17	0	25	40
18-Jul		0	41	6	20	0	43	21
19-Jul		0	21	24	1	5	41	54
20-Jul		0	29	17	3	2	46	35
21-Jul		0	28	110	48	5	26	60
22-Jul		0	28	160	24	28	41	53
23-Jul		0	50	182	61	21	49	156
24-Jul	1	2	112	195	20	46	41	48
25-Jul	26	0	124	141	61	25	15	50
26-Jul		0	69	113	29	44	61	50
27-Jul	12	0	61	144	10	108	64	12
28-Jul		0	43	78	17	40	51	47
29-Jul	3	0	98	41	42	83	74	54
30-Jul	5	0	111	51	35	54	79	25
31-Jul		8	54	74	3	84	31	72
1-Aug	28	8	22	47	3	42	75	64
2-Aug	151	102	27	43	5	54	30	45

3-Aug	38	76	11	162	0	37	40	19
4-Aug	30	122	13	47	0	23	30	27
5-Aug	17	143	13	24	7	21	19	47
6-Aug	28	184	44	63	2	48	52	28
7-Aug	12	122	32	18	29	24	34	17
8-Aug	13	78	10	27	44	45	19	34
9-Aug	6	44	44	27	26	39	25	11
10-Aug	12	11	95	80	2	14	14	24
11-Aug	9	11	29	48	13	3	17	15
12-Aug	4	26	18	63	11	15	8	10
13-Aug	17	3	7	26	7	10	14	15
14-Aug		0	22	12	14	14	7	14
15-Aug	2	0	14	9	94	7	13	10
16-Aug	3	3	11	12	24	6	7	17
17-Aug	6	0	5	7	14	6	11	7
18-Aug	10	2	11	7	5	23	7	18
19-Aug	4	5	19	9	7	11	7	6
20-Aug	3	9	13	4	3	34	8	7
21-Aug	4	0	6	16	3	15	4	15
22-Aug	5	7	2	12	1	8	2	3
23-Aug	4	1	19	9	0	23	3	1
24-Aug	4	0	16	12	2	12	5	3
25-Aug		0	13	7	1	12	5	0
26-Aug		0	2	19	10	7	1	0
27-Aug		0	3	15	3	3	1	0
28-Aug		0	4	6	0	9	2	0
29-Aug				6	2	6	0	7
30-Aug			1	7	0	0	2	10
31-Aug			1	2		2	2	7
1-Sep			1	0		0	3	1
2-Sep				0		0	2	0
3-Sep				0		3	2	5
4-Sep							1	6
5-Sep							2	0
6-Sep							2	
7-Sep							0	
8-Sep							4	
9-Sep							0	
Totals	457	967	2664	2555	728	1123	1427	1943

*Yellow blocks denote days that the lower weir was closed and the blast occurred at about noon on the 28th (red).